From: Eric Vander Mey <ericv@rushingco.com>
Sent: Friday, October 14, 2022 12:11 PM
To: DES SBCC
Cc: Braaksma, Krista (DES); Caroline Traube; Reed Rushing
Subject: 2021 WSMC - Public Testimony - 501.3.1 - Transformer Vault Exhaust Location

External Email

Public Comment on Log #21-PG2-019

See below for recommendations to clarify the requirements for utility transformer exhaust locations.
Referring to the NFPA 70 is not clear and enforceable code language as this section is in regard to naturally ventilated transformer vaults.
So it is unclear if this even applies to mechanically exhausted transformer vaults.
Additionally, the NFPA language is very general with terms like "as far as possible from" in 450.45 (A).

See recommended revisions in red below.

450.45 Ventilation Openings. Where required by 450.9, openings for ventilation shall be provided in accordance with 450.45(A) through (F).

(A) Location. Ventilation openings shall be located as far as possible from doors, windows, fire escapes, and combustible material.

Proposed Code Language per Public Review Draft:
501.3.1 Location of Exhaust Outlet. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:
6. For transformer vault exhaust system outlets, in addition to the requirements of NFPA 70 Section 450.45: 10 feet (3048 mm) from property lines which separate one lot from another; 10 feet (3048 mm) from operable openings into buildings; 10 feet (3048 mm) above any walking walkway.

Proposed Modifications to the Code Language below in red:
501.3.1 Location of Exhaust Outlet. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:
6. For transformer vault exhaust system outlets~~, in addition to the requirements of~~ subject to the requirements of NFPA 70 Section 450.45: 10 feet (3048 mm) from fire escapes, required means of egress at the exterior of the building, elements of exit discharge, exterior combustible materials, openings that are not protected in accordance with IBC Section 705.8; 10 feet (3048 mm) from property lines which separate one lot from another; 10 feet (3048 mm) from operable openings into buildings; 10 feet (3048 mm) above any walking walkway.

NPFA 70-2020: Sections 450.9 & 450.45:

450.9 Ventilation. The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.

Informational Note No. 1: See IEEE C57.12.00-2015, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, and IEEE C57.12.01-2015, *General Requirements for Dry-Type Distribution and Power Transformers*.

Informational Note No. 2: Additional losses occur in some transformers where nonsinusoidal currents are present, resulting in increased heat in the transformer above its rating. See IEEE C57.110-2008, *Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents*, where transformers are utilized with nonlinear loads.

Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.

Part III. Transformer Vaults

450.41 Location. Vaults shall be located where they can be ventilated to the outside air without using flues or ducts wherever such an arrangement is practicable.

450.42 Walls, Roofs, and Floors. The walls and roofs of vaults shall be constructed of materials that have approved structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with the earth shall be of concrete that is not less than 100 mm (4 in.) thick, but, where the vault is constructed with a vacant space or other stories below it, the floor shall have approved structural strength for the load imposed thereon and a minimum fire resistance of 3 hours. For the purposes of this section, studs and wallboard construction shall not be permitted.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note No. 1: For additional information, see ASTM E119-18a, *Methods for Fire Tests of Building Construction and Materials*.

Informational Note No. 2: A typical 3-hour construction is 150 mm (6 in.) thick reinforced concrete.

450.43 Doorways. Vault doorways shall be protected in accordance with 450.43(A), (B), and (C).

(A) Type of Door. Each doorway leading into a vault from the building interior shall be provided with a tight-fitting door that has a minimum fire rating of 3 hours. The authority having jurisdiction shall be permitted to require such a door for an exterior wall opening where conditions warrant.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note: For additional information, see NFPA 80-2016, *Standard for Fire Doors and Other Opening Protectives.*

(B) Sills. A door sill or curb that is of an approved height that will confine the oil from the largest transformer within the vault shall be provided, and in no case shall the height be less than 100 mm (4 in.).

(C) Locks. Doors shall be equipped with locks, and doors shall be kept locked, with access being allowed only to qualified persons. Personnel doors shall open in the direction of egress and be equipped with listed fire exit hardware.

450.45 Ventilation Openings. Where required by 450.9, openings for ventilation shall be provided in accordance with 450.45(A) through (F).

(A) Location. Ventilation openings shall be located as far as possible from doors, windows, fire escapes, and combustible material.

(B) Arrangement. A vault ventilated by natural circulation of air shall be permitted to have roughly half of the total area of openings required for ventilation in one or more openings near the floor and the remainder in one or more openings in the roof or in the sidewalls near the roof, or all of the area required for ventilation shall be permitted in one or more openings in or near the roof.

(C) Size. For a vault ventilated by natural circulation of air to an outdoor area, the combined net area of all ventilating openings, after deducting the area occupied by screens, gratings, or louvers, shall not be less than 1900 mm^2 (3 $in.^2$) per kVA of transformer capacity in service, and in no case shall the net area be less than 0.1 m^2 (1 ft^2) for any capacity under 50 kVA.

(D) Covering. Ventilation openings shall be covered with durable gratings, screens, or louvers, according to the treatment required in order to avoid unsafe conditions.

(E) Dampers. All ventilation openings to the indoors shall be provided with automatic closing fire dampers that operate in response to a vault fire. Such dampers shall possess a standard fire rating of not less than 1½ hours.

Informational Note: See ANSI/UL 555-2016, *Standard for Fire Dampers.*

(F) Ducts. Ventilating ducts shall be constructed of fire-resistant material.

For Reference:

2018 Seattle Building Code Provisions:

430.7.3 Ventilation openings and duct terminations. Ventilation openings and duct terminations shall comply with *International Mechanical Code* Section 501.3.1 item 7, unless otherwise *approved* by the *building official*.

430.7.3.1 Location of exhaust ventilation openings and exhaust duct terminations. Exhaust ventilation openings and duct terminations shall be located not less than 10 feet (3048 mm) from fire escapes, required means of egress at the exterior of the building, elements of the exit discharge, combustible exterior wall coverings, openings that are not protected in accordance with Section 705.8, operable openings and property lines other than a public way and above finished walking surfaces. Exhaust outlets shall be located on the exterior of the building.

2018 Seattle Mechanical Code Provisions:

501.3.1 Location of exhaust outlets. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:

[S] 7. For transformer vault exhaust systems: Exhaust ventilation openings and duct terminations shall be located not less than 10 feet (3048 mm) from fire escapes, required means of egress at the exterior of the building, elements of the exit discharge, combustible exterior wall coverings, unprotected openings, operable openings and property lines other than a public way. Exhaust outlets shall be located on the exterior of the building. See Seattle Building Code Section 430 for additional requirements.

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